Oxidation of Mercury via Catalytic Barrier Filters – Phase II
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University of North Dakota
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Abstract

Coal combustion is a significant source of Hg emissions to the atmosphere, accounting for about one-third of the anthropogenic mercury emissions in the United States. Oxidizing elemental mercury can increase the effectiveness of control devices for the removal of mercury from flue gas prior to emission. In this project we are studying the effectiveness of using catalyst coated filter bags to improve elemental mercury oxidation in coal combustion flue gas streams. The excellent gas/catalyst contacting that can be provided by barrier filters is expected to overcome the current gas-diffusion limitations of competing technologies, i.e. packed beds and entrained injection. This should substantially reduce the amount of catalyst required to accomplish removal of elemental mercury. Further, for existing and planned facilities utilizing barrier filters, this oxidation can be accomplished with virtually no additional capital expense.

Three primary tasks in the project are: 1) evaluation of coating methods (complete), 2) bench-scale parametric testing of catalysts in simulated gas streams (in progress), and 3) lab-scale performance testing in a 17kW downflow combustion system (pending). In task 1, it was found that spray coating appears to be a simple and effective technique. A test apparatus was constructed to automatically simulate back pulse of the filters. Filter samples are back pulsed up to 3000 times to determine the long term integrity of the catalyst coating. For task 2, bench-scale experiments are in progress using a simulated flue gas containing Cl_2, HCl, NO, SO_2, H_2O, N_2, and O_2. We are investigating oxidation capabilities of TiO_2, Au on TiO_2, and Pd on Al_2O_3. Oxidation, oxidation inhibition, and catalyst poisoning potential of common flue gas constituents will be investigated. In task 3, the performance of the catalyst in a baghouse that services a 17kW research combustor will be tested with bituminous, sub-bituminous, and lignite coals. The bag in this baghouse is 30 inches long with a 6 inch diameter.